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HUNTING MOLLUSCA IN UTAH AND IDAHO IN 1916.

BY JUNIUS HENDERSON AND L. E. DANIELS.

We were in Utah and southern Idaho from June 10 to July 24, 1916, continuing the work begun in 1915.[1] More attention was given to fresh-water species and the smaller land snails than before, with some interesting results. A vast amount of work remains to be done in this region before the molluscan faunas and the significance of their present distribution are thoroughly understood.

The known Tertiary and Pleistocene history of the Salt Lake Basin is such that it must vitally affect the present distribution of species, as well as possibly influencing local variations. Great Salt Lake and Utah Lake, both within the area covered by this report, are among the remnants of a much larger body of water known to geologists as ancient Lake Bonneville. During Pleistocene time it extended over a large part of Utah and into Idaho, with a depth of hundreds of feet. In its retreat it left a fine series of terraces around the margin of its basin to mark the various stages of its recession. The formations deposited beneath the waters of the ancient lake, the fluctuations of its water level, and its molluscan life as revealed by the numerous fossils contained in the lacustrine deposits have been subjects of extensive investigation and discussion.[2]

The aridity of the vast area between the Rocky Mountains and the Sierra doubtless dates well back into Pliocene time. The changes in the water level in the various lake basins do not necessarily imply periods of great humidity. Each receives the drainage of a large territory, and being completely land-locked, a slight increase in the precipitation for a short cycle may extend the borders of the lakes far out over the flat, low-lying area around the lake margins, and increased precipitation for a longer period may fill the basins to overflowing. The rise and fall of the waters of land-locked lakes constitute a complete and accurate record of the net result of all the climatic factors, chief of which are precipitation and temperature, evaporation being an expression of the relations of temperature to humidity. Even within the short period of occupation by the white race, notable changes in the area of Great Salt Lake and other lakes of the region have been recorded, but these changes have been insignificant when compared with those shown by the geological record. In Pleistocene time there were at least two periods of enormous expansion and contraction. During these expansions the Oquirrh and some of the other mountain ranges were peninsulas projecting far out into the lake, while the southern part of Promontory Range and many other small ranges were islands. Thus during the periods of great extension the direct intercommunication of the land-snail faunas of the several mountain ranges was either partially or wholly prevented by the intervening waters. During the recession periods between the major expansions, as well as during the long periods before the first expansion and after the last contraction, many of these mountain areas were nearly as well insulated by wide expanses of territory apparently quite unfavorable to land snails, especially the larger snails of the genus *Oreohelix*. It is well to note, however, that as work upon this genus progresses, flourishing colonies of the living snails are found from time to time in unexpected places, where the cover does not seem at all good. It should also be kept in mind that very few of the isolated mountain ranges have been explored at all, and none of them thoroughly explored, by conchologists. Hence the last word on this phase of the subject cannot be written, even aside from the possibility of the accidental transportation of snails by birds and other agencies. Turning now to the fresh-water mollusks, direct intercommunication of the faunas of such streams as the Bear River, flowing into Great Salt Lake from the north, and the Jordan, entering from the south, has been prevented ever since the last contraction of Lake Bonneville by the extremely saline waters of the lake, which form a complete barrier, as effectual as a land barrier. This salinity is due to the fact that the lake is land-locked. The streams pour their waters, containing salts dissolved from the soil and rocks, into the lake. There, in the absence of an outlet, the loss is wholly by evaporation, which leaves the salts in the water, thus maintaining a concentrated solution, while Utah Lake, Bear Lake and others with outlets remain fresh. However, during what is known as the "Lake Epoch," Lake Bonneville once or twice reached such depth that it established an outlet at the north end of the Cache Valley in Idaho, resulting in the temporary freshening of the water. Hence it is not surprising that certain strata in the lacustrine deposits contain numerous fossil shells. Nearly all the species in this fossil fauna are still found living in some part of the Bonneville Basin, as was long ago pointed out by Call and Gilbert. The drainage during the overflow period also afforded communication between the various rivers of the basin and the Port Neuf River to the north, thus easily explaining the observed similarity in their faunas.

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[1] Proc. Acad. Nat. Sci. Phila., LXVII, pp. 315–339, 1916.

[2] See especially the following: Gilbert, G. K., "Contributions to the History of Lake Bonneville," U. S. Geol. Surv., 2d Ann. Rept., pp. 167–200, 1882, with plates and map; "Lake Bonneville," U. S. Geol. Surv., Monographs, vol. 1, 1890, with plates and map. Call, R. Ellsworth: "On the Quaternary and Recent Mollusca of the Great Basin, with descriptions of new forms," U. S. Geol. Surv., Bull. No. 11, 1884.

Our work in the region has developed a peculiar and as yet unsolved problem in the breeding habits of the genus *Oreohelix*. The genus is viviparous. In 1915 the snails of the genus collected in the last week in August contained many embryos, but those obtained after the first two or three days in September contained few or none. In 1916 we found very few embryos during the months we were in the field, June and July, yet if the embryos were to be so fully developed by the last of August as to be all gone early in September, as in 1915, it seems that they should have been developing by the middle of July. To add to our perplexity, a considerable number of live snails which were found among the dead shells in cleaning them in November and December, nearly all contained embryos of 1½ or 2 whorls. These must have developed after July while the snails were dormant.

Over a large portion of the region covered by this report, the combined effects of brush fires and overgrazing, with the consequent erosion, have played sad havoc with the cover for land snails. In some places where the steep slopes below clumps of bushes were almost white with bleached *Oreohelix* shells, the washing of the soil and dead leaves from beneath the shrubs had totally destroyed the cover, so that not a living snail could be found, and the shrubs themselves must die as erosion continues to take the soil away from the roots.

We have continued our station numbers from the 1915 expedition, and revisited several of the 1915 stations to obtain more material and data. We also include in this report some material obtained by Daniels in 1915 at Idaho Falls, Dubois, McCammon, and Weston, but not hitherto recorded, together with some unrecorded material in the University of Colorado Museum, in order to keep all our Utah and Idaho records together.

We gratefully acknowledge the assistance of several who have aided in the determination of difficult material. The Sphæriidæ were examined by Dr. V. Sterki. Dr. Bryant Walker has identified or confirmed the identifications of the Physas and Lymnæas, as well as some of the other fresh-water snails. Dr. H. A. Pilsbry has determined many of the smaller and more difficult land snails and has examined both shells and soft anatomy of the Oreohelices. The Physas and Sphæriidæ of the region are not well understood and difficult at the best. Hence many of the determinations must be considered tentative. In a number of instances, also, the material is in poor condition for determination.

RUPERT, IDAHO.

The following species in the University of Colorado Museum were collected by Mr. Fayre Kenegy, along the Snake River, near Rupert, in 1913:

Pisidium sp.
Sphærium sp.
Anodonta nuttalliana Lea.
Fluminicola fusca (Hald.).
Lymnæa near *traskii* Tryon.
Physa sp.
Ancylus crassus Hald.

The *Sphærium* is apparently the same puzzling species as that from Sta. 74, near Ovid, Idaho.

IDAHO FALLS, IDAHO.

The following species were collected by Daniels, in and on the banks of Snake River, Idaho Falls, in August, 1915:

Sphærium near *aureum* Prime.
Pisidium compressum Prime, var.
Zonitoides nitida (Müll.).
Succinea haydeni W. G. B.
Succinea oregonensis gabbii Tryon?
Fluminicola fusca (Hald.).
Lymnæa humilis modicella Say.
Lymnæa humilis rustica Lea.
Lymnæa apicina solida Lea.
Planorbis parvus Say.
Physa near *gyrina* Say.
Physa ampullacea Gld.

The Lymnæas and Physas were identified by Walker. We record *Physa ampullacea* from a number of stations, all the material having been identified or identifications confirmed by Walker. Gould[3] described this form from Oregon, under the name *P. bullata*, in 1855. In 1865 Binney[4] republished the description, figured the species, and, at Gould's suggestion, renamed it *ampullacea*, the name *bullata* being preoccupied. He recorded it also from Washington. Meantime, in 1864, Lea[5] described *Physa nuttallii*, from Lewis River, Oregon, but did not figure it. If, as we suspect and as Dr. Pilsbry (Mss.) concluded some years ago, these names are synonyms, *nuttallii* has priority. In that event, all our records of *P. ampullacea* should be changed to *nuttallii* Lea.

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[3] *Proc. Boston Soc. Nat. Hist.*, V, p. 128, 1855.

[4] Land and Fresh Water Shells of North America, Part II, p. 79, figs. 133, 134, 135, 1865.

The *Sphærium* from Idaho Falls and the McCammon stations are doubtfully referred to *S. aureum* Prime by Sterki. The beaks of the McCammon examples are less elevated than the beaks of the Idaho Falls material.

The type locality of *Lymnæa hinkleyi* Baker is the North Fork of Snake River, eastern Idaho, and therefore must be not far north or northeast of Idaho Falls. The type locality of *Lymnæa jacksonensis* Baker is Jackson Lake, Wyoming, which is drained by the South Fork of Snake River, and the species is also recorded from Snake River. Baker, in his monograph, records *Lymnæa apicina solida* Lea from Salmon River, Idaho.

DUBOIS, IDAHO.

In August, 1915, Daniels collected the following species in Beaver Creek, at Dubois:

Pisidium compressum Prime.
Pisidium sp.
Lymnæa humilis rustica Lea.
Lymnæa proxima Lea.
Physa sparsestriata Tryon?

THE MCCAMMON, IDAHO, DISTRICT.

We revisited stations 1, 1½ and 2, of 1915, and also established several other stations.

Sta. 1, west side of Port Neuf River, about a mile north of McCammon. *Oreohelix cooperi* (W. G. B.) is very abundant under wild cherry, wild rose and various shrubs, among large blocks of lava at the foot of a low bluff. *Pyramidula cronkhitei anthonyi* Pils., three dead shells. On the banks of the near-by slough we found *Lymnæa proxima* Lea, *Pisidium* (Sterki says *P. huachucanum* Pils., compare also *P. ashmuni*), and *Physa ampullacea* Gld. In 1915 at this place Daniels found a few *Succinea*, doubtfully identified at the time by Walker as *S. oregonensis gabbi* Tryon. Pilsbry says: "It is not *gabbi*. Just what it is I do not know. Has the microscopic sculpture of *stretchiana*, but seems too big and too long. With a good series one might come to some conclusion."

Sta. 62, Port Neuf River, east of Sta. 1. *Sphærium* near *aureum*

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[5] PROC. ACAD. NAT. SCI. PHILA., XVI, p. 116, 1864.

Prime and *Fluminicola fusca* (Hald.), both abundant, one example of *Physa* identified by Walker as *P. ampullacea*, var. close to *propinqua*.

Sta. 1½, about ten miles above McCammon, on south side of Port Neuf River, north side of gulch on east side of mountain about three miles south of west from Lava Hot Springs.

Oreohelix tenuistriata H. and D.

This is the type locality of the species, the description of which was based upon three imperfect and immature examples. We revisited the station, where a search of several hours resulted in obtaining about thirty specimens alive, mostly immature, and twice as many dead shells, under shrubs and mats of the radical leaves of *Balsamorrhiza sagittata* (Nutt.), overhanging small piles of limestone, in open spaces among the mountain mahoganies, which are here the largest we have seen. The dense blanket of small leaves directly under the mahoganies is not favorable to the snails. This material shows that the species is a larger, finer one than was indicated by the type and co-types, and compels an amendment of the description, as follows: Shell rather depressed to moderately elevated; whorls 5, convex, carinated almost to the aperture; color very light brown, with two almost undiscernible darker spiral bands, one well above, the other scarcely below, the periphery. The spiral riblets on the best specimens, especially bleached ones, may be seen with the unaided eye. The two largest examples measured are each 13.5 mm. in major diameter, and one is 8 mm., the other 9.5 mm. in altitude. Otherwise the original description holds good. The beautiful sculpture distinguishes it from all other species of the genus we have examined. Pilsbry writes that in genitalia this species is of the *haydeni* type.

In the gulch bottom, just below the *Oreohelix* slope, among aspens and mountain maples, we obtained *Vitrina alaskana* Dall, *Zonitoides arborea* Say, *Vallonia cyclophorella* Ancey and *Euconulus fulvus alaskensis* Pilsbry.

Sta. 63, next gulch north of Sta. 1½. We found here a few *Oreohelix tenuistriata* H. & D.

Sta. 64, bank of Port Neuf River, two or three miles below Sta. 63. We obtained here the following:

Sphærium near *aureum* Prime, abundant.
Succinea avara Say.
Succinea rusticana Gld.
Pyramidula cronkhitei anthonyi Pils.
Fluminicola fusca (Hald.).
Lymnæa humilis modicella Say.
Planorbis parvus Say.

It is probable that the *Sphærium* and the *Fluminicola* may be found in favorable situations all along the stream, and the former was noted as a fossil in the alluvial banks of the river at several places.

Sta. 2, south side of Harkness Canyon, at the springs near a great white cliff plainly visible from McCammon. The large, heavy-shelled *Oreohelix strigosa depressa* (Ckll.), noted for this station in our former report, occurs in limestone slides on a steep slope almost concealed by a heavy cover of conifers, with an undergrowth of mountain maples and various shrubs. A conifer forest is an unusual habitat for such a fine colony of *Oreohelix.* In the bottomland below the slides we found dead shells of *Thysanophora ingersolli* (Bland) plentiful in fine drift wood, and a short distance down the canyon we obtained *Euconulus fulvus alaskensis* Pils., *Zonitoides arborea* (Say), *Vitrina alaskana* Dall and *Vallonia cyclophorella* Ancey.

Sta. 65, east side of gulch coming into Harkness Canyon from the north, above Sta. 2. Large *Oreohelix strigosa depressa* (Ckll.) abundant, in more open, cleaner slides than at Sta. 2, with few trees and much less shrubbery and herbage.

Sta. 66, Goodenough Canyon, on east side of a mountain range about five miles west of McCammon. We drove to the end of the road up the canyon, then walked a mile further. Found no limestone, no good rock slides and no *Oreohelix,* but under leaves and sticks we obtained the following:

Zonitoides arborea (Say).
Pyramidula cronkhitei anthonyi Pils.
Vitrina alaskana Dall.
Thysanophora ingersolli (Bland).
Euconulus fulvus alaskensis Pils.
Punctum n. sp.
Vertigo modesta parietalis (Ancey).

BEAR LAKE VALLEY IDAHO AND UTAH.

Bear Lake, at an altitude of 5,925 feet, is about nineteen miles long (north to south) and from six to eight miles in width, bisected by the Utah-Idaho boundary line. It is bounded on the east, west and south by mountains, but the broad valley extends to the northward beyond Montpelier to Bennington, thus giving the valley a length of forty miles, drained by the Bear River, which flows into Great Salt Lake. In the Geologic Atlas of the United States (United States Geological Survey) the region is covered by the Montpelier (Idaho) and Randolph (Utah) Quadrangle sheets. We did not visit the eastern or southern shores of the lake, but spent half a day at the northern end and examined the western shore at various places. We found no living mollusks in the lake itself. This may be due to the fact that the water was considerably above the usual level and we were not prepared for dredging. The sloughs and streams of the valley furnished quite a number of species of fresh-water mollusks alive, and the mountains and canyons bordering the valley yielded land snails.

Sta. 67, just within the mouth of Montpelier Canyon, northwest of Montpelier, Idaho, on the south side of the canyon. *Oreohelix cooperi* (W. G. B.) abundant, mostly immature, under shrubbery on slope beneath a limestone ledge almost devoid of rock slides. Although the snow from a two days' storm (June 20–21) was just melting, on June 22 the snails were all active and hence easy to find. Mature examples from this station measure about 20 mm. in diameter. *Vitrina alaskana* Dall was noted on a ditch bank. This *Vitrina* we found at almost every station where we found *Oreohelix*, but we did not always collect it and perhaps in some instances failed to record it in the notebook.

Sta. 68, three miles up Montpelier Canyon, on the north side of a ravine that comes in from the east. *Oreohelix cooperi* (W. G. B.) plentiful, nearly all mature, in limestone rock slides, mature examples varying from 17 mm. to 21.5 mm. in diameter, mostly about 20 mm.

Sta. 69, south side of the same gulch, opposite Sta. 68 and not more than 150 feet distant. *Oreohelix cooperi* (W. G. B.), live examples scarce, dead shells plentiful, under shrubbery on a limestone slope devoid of rock slides. Though separated from Sta. 69 only by the narrow bed of the gulch and with the more favorable north exposure, the snails here are much smaller, the shells varying from 13.5 mm. to 15.5 mm. in diameter. Lack of cover does not appear to be the cause of the difference in size, as the cover at Sta. 67 is about the same.

Sta. 70, canyon about two miles north of Montpelier. *Oreohelix cooperi* (W. G. B.), of fair size, but not plentiful, in edges of limestone slides.

Sta. 71, a short distance up Bennington Canyon, east of Bennington (north of Montpelier). *Oreohelix cooperi* (W. G. B.), large, robust, very abundant under shrubbery, especially wild roses, on steep banks of creek, active among the tiny patches of snow remaining from the late storm. None found in the big sandstone slides on the slope above the brush and trees of the narrow bottomland.

Sta. 72, sloughs on east side of Bear River, on both sides of the Montpelier-Ovid wagon road. We here obtained the following:

Sphærium sp.
Musculium n. sp.
Succinea rusticana Gld.
Valvata humeralis californica Pils.
Lymnæa stagnalis appressa Say.
Lymnæa proxima Lea.
Lymnæa utahensis Call.
Planorbis trivolvis near *binneyi* Tryon.
Planorbis parvus Say.
Planorbis exacuous Say.
Physa ampullacea Gld.
Aplexa hypnorum (Linn.).

The *Planorbis trivolvis* at all stations in this valley reaches great size—up to 35 mm. in diameter in some instances. They have the strong transverse sculpture of the variety *binneyi*, but the whorls are not quite so conspicuously strap-like as those from Sta. 127 at Utah Lake. Caddis larvæ cases from one of the sloughs are composed almost wholly of *Planorbis parvus*, *P. exacuous* and other small shells and shell fragments. *Planorbis exacuous* was described by Say,[6] in 1821, under this name as thus spelled, apparently a poorly formed adjective from *exacuo* or from *acuo*, referring to the sharp periphery. It should have been spelled either *exacuus* or *exacutus*. Gould,[7] in 1841, inserted the *t*, saying:

"I cannot but think that the name under which this shell appears in the 'Journal of the Academy,' is not exactly as it was intended by the author, as it is neither a Latin word nor a Latin termination. Supposing that by a typographical error, an *o* has taken the place of a *t*, we have a legitimate term, and one very expressive of the form of the shell."

In his synonymy he gives the original spelling. Haldeman, in his monograph, 1842, follows Gould, but in the synonymy he also cites the name as originally published. Unfortunately, Binney,[8] in 1865, adopting Gould's form of the name, in his synonymy of the species cited Say's original description as though it had been spelled *exacutus*. As the latter is the work most generally accessible and used for reference, it has misled many subsequent writers. If the original name were clearly a misprint and we could ascertain just what was intended, the rules of nomenclature would justify its correction. It is conceivably, though not likely, a case of poor judgment in the formation of the word, and not a typographical error. If a printer's error, it seems more likely that the printer, well accustomed to the common English syllable *ous*, had carelessly inserted an *o* in *exacuus*, than that he had replaced the *t* in *exacutus* with an *o*. We have no way of ascertaining which form the author intended. Hence we believe the original spelling should be retained, bad as it is, and it is no worse in this respect than many other names in general use.

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[6] JOURN. ACAD. NAT. SCI. PHILA., II, p. 165, 1821.

[7] A Report on the Invertebrata of Massachusetts, pp. 208–209, 1841. See also Binney's edition of the same, pp. 495–496, 1870.

[8] Land and Fresh Water Shells of North America, Part II, p. 126.

Sta. 74, southwest of Sta. 72, about two miles north of east from Ovid, Idaho, where the railroad track crosses Bear Lake outlet. Dead shells of the following species were found in the loose sand on the bank of the stream:

Sphærium sp.
Pisidium compressum Prime.
Pisidium near *variabile* Prime.
Anodonta wahlametensis Lea? 1 broken valve.
Succinea haydeni W. G. B.? 2 broken shells.
Fluminicola fusca (Hald.).
Valvata humeralis californica Pils.
Valvata utahensis (Call).
Carinifex newberryi (Lea).
Lymnæa proxima Lea.
Planorbis trivolvis near *binneyi* Tryon.
Planorbis parvus Say.

The *Sphærium* is very large, but Sterki does not consider it *S. pilsbryanum* St., which would be expected in this vicinity. He does not venture to name these specimens.

Sta. 75, slough from Mill Creek drainage, beside the railroad track, a mile north of east from Ovid. *Musculium* n. sp. abundant, gravid.

Sta. 76, Mill Creek, where railroad crosses it south of Ovid.

Anodonta nuttalliana Lea, one alive.
Sphærium sp., 3 fresh shells.
Fluminicola fusca (Hald.).
Lymnæa stagnalis appressa Say.
Planorbis trivolvis near *binneyi* Tryon.
Physa ampullacea Gld.

Sta. 73, three or four miles up Paris Canyon, west of Paris, Idaho. *Oreohelix cooperi* (W. G. B.) common under shrubbery on limestone slopes devoid of slides. A search for small snails in an aspen grove near by proved surprisingly fruitless.

Sta. 77, half a mile up St. Charles Canyon, west of St. Charles, Idaho. *Oreohelix haydeni hybrida* (Hemph.), with sculpture less pronounced than in the Logan colony, common under the radical leaves of *Balsamorrhiza sagittata* and shrubs, on a limestone slope devoid of rock slides. A few *Vallonia cyclophorella* Ancey and quite a number of *Pupilla muscorum idahoensis* n. subsp. were found.

Pupilla muscorum idahoensis n. subsp.

Differs uniformly from typical *P. muscorum* (L.) in its more slender form and thinner lip. Color light to dark brown. The type, in the University of Colorado Museum, measures 3.1 mm. in altitude, 1.3 mm. in width. Whorls 6. Common at Sta. 77, west of St. Charles, Idaho, June 27, 1916.

Sta. 78, natural turnpike forming the northern barrier of Bear Lake and separating it from Mud Lake and Dingle Swamp. The sandy soil of this broad barrier is in places composed largely of fossil shells of the same species that abound along the beach, leading to the belief that the beach shells have mostly been washed from the sand by the waves and are fossil. Though we found no live mollusks in the lake, many of the shells, especially *Lymnæa* and *Planorbis*, were rather fresh, and all were of species that might be expected to now live in the region, though only two or three of the species were actually taken alive in the valley. As the lake is now used to regulate the flow of water in the streams and ditches, the water level fluctuates considerably, and at the time of our visit the water in the lake, as well as in the streams, was high. The beach material yielded the following:

Sphærium pilsbryanum Sterki.
Pisidium compressum Prime.
Pisidium n. sp.
Pyramidula cronkhitei anthonyi Pils.
Vertigo ovata (Say).
Fluminicola fusca (Hald.).
Paludestrina longinqua (Gld.).
Carinifex newberryi (Lea).
Valvata humeralis californica Pils.
Valvata utahensis (Call).
Planorbis trivolvis near *binneyi* Tryon.
Planorbis parvus Say.
Planorbis exacuous Say.
Physa ampullacea Gld.
Ancylus sp.
Lymnæa proxima Lea.
Lymnæa stagnalis appressa Say.
Lymnæa utahensis Call.

Baker, in his Lymnæidæ of North America, records *L. proxima* also from the Utah end of the lake. *L. utahensis* at this station is on the average more elongate than those from the type locality at Utah Lake, but on the whole they cannot be separated. *Valvata h. californica* is here more highly polished and closely coiled than at Sta. 127, Utah Lake.

Sta. 79, roadside pools west of Sta. 78, near St. Charles. *Lymnæa proxima* Lea and *Aplexa hypnorum* (L.).

Sta. 80, bank of St. Charles Creek, at the north edge of the town:

Agriolimax campestris montana (Ing.).
Succinea avara Say.
Zonitoides arborea (Say).
Pyramidula cronkhitei anthonyi Pils.
Euconulus fulvus alaskensis Pils.

Sta. 81, three miles up St. Charles Canyon, west of St. Charles, Idaho. *Oreohelix strigosa depressa* (Ckll.) found sparingly in sandstone slides and about limestone ledges. In the water-cress of a small seepage channel from the creek we found:

Paludestrina longinqua (Gld.).	*Lymnæa obrussa* Say.
Physa ampullacea Gld.	*Succinea rusticana* Gld.

Sta. 82, mouth of Garden City Canyon, west of Garden City, Utah, on south side of canyon. *Oreohelix haydeni hybrida* (Hemph.), typical, as at Logan, common under small shrubs, and especially under the matted radical leaves of *Balsamorrhiza sagittata* (Nutt.), on limestone slopes devoid of rock slides. We also found a few *Pupilla blandi* (Morse). The slopes are now very barren, but we were informed by pioneers that forty-five years ago they were well covered with large mountain mahogany, up to a foot in diameter, as at Sta. 1½, in the McCammon district. These trees furnished fuel for the early settlers, but wasteful cutting and fires have denuded the hills for some miles back, and overgrazing by stock has been disastrous to the smaller shrubs and herbs. It is difficult to believe that snails could obtain a foothold under present conditions, but having flourished here under more favorable conditions, they have been able thus far to survive the change in environment. Erosion is rapidly carrying the soil and vegetative debris from beneath the scant shrubbery and may soon destroy the colony, unless saved by a series of years of increased moisture favorable to plant growth.

Sta. 83, south side of next canyon south of Sta. 82 and about half a mile distant. *Oreohelix cooperi* (W. G. B.) abundant, but much smaller than at most localities where we have found this species (diameter 14 mm. to 15.5 mm.). These specimens agree with those from Eureka, Utah, in their small size and the absence of the color bands from below, many of them having no color bands at all.

Sta. 84, stagnant pool by the roadside, two miles south of Garden City, Utah. *Lymnæa obrussa* Say abundant, *L. humilis modicella* Say rare.

Sta. 85, along wagon road from Garden City to Logan, a mile east of the "Sink Holes," east of the crest of the divide. We picked up one large bleached shell of *Oreohelix cooperi* (W. G. B.), but, as we had a hard day's trip ahead, we did not stop to search for more.

PRESTON, IDAHO.

Sta. 97, bank of Bear River, south and southeast of the wagon bridge due west of Preston. A layer of sand in the bank, several feet in thickness, yielded the following fossils:

Margaritana margaritifera L. ?
Sphærium sp.
Succinea grosvenori Lea ?
Fluminicola fusca (Hald.).
Lymnæa traskii Tryon.

Sta. 98, bottomland near Sta. 97. *Oreohelix cooperi* (W. G. B.) abundant under leaves in clumps of rose bushes, scrub willows, etc. This station, a flat soil area entirely free from rocks and some distance from ledges, is an unusual site for a fine colony of *Oreohelix*. The same species is common under similar conditions at Montrose, Colorado.

Sta. 99, slough west of Sta. 98, north of wagon road. *Lymnæa traskii* Lea (?), dead shells abundant, fairly fresh; live examples not found. *Physa ampullacea* Gould, one dead shell. A similar slough across the road yielded no mollusks at all.

Sta. 100, muddy bank of river due north of Sta. 99. *Succinea avara* Say common under overhanging willows.

WESTON, IDAHO.

Sta. 59, cliff of igneous rock about three miles northwest of Weston. Though the place, from a distance looked like good snail territory, we succeeded in finding only a very few scorched shells which seem to be a small form of *Oreohelix strigosa depressa* (Ckll.). A year or two before, a fierce fire had swept the mountain, burning the leaves and sticks to the very bottom of the rock slides, but the scarcity of "bones" shows that the snails were not at all plentiful before the fire. We also visited a good-looking mountain southwest of Weston, in the northern edge of Utah, but found no snails there.

Sta. 60, irrigating ditch southeast of Sta. 59, about one-third of the way to town:

Succinea oregonensis Lea.
Lymnæa humilis modicella Say.
Lymnæa bulimoides cockerelli Pils. and Ferr.
Physa crandalli Baker ?

So far as we know, this is the only record of *L. b. cockerelli* for Idaho, though the Montana, Colorado, New Mexico and Nevada records would lead one to expect it in Idaho, Utah and Wyoming.

Sta. 61, stagnant roadside pool southeast of Sta. 60, about a mile northwest of Weston. *Lymnæa traskii* Tryon (typical, according to Walker), common, young very abundant.

In 1915 Daniels obtained from the banks of the Bear River, east of Weston, *Succinea haydeni* W. G. B. and *Lymnæa proxima* Lea.

THE FRANKLIN DISTRICT, IDAHO AND UTAH.

Franklin is only a mile or two north of the southern boundary of Idaho, due east of Weston. We visited a good-looking hill about four miles northeast of town, where we found the vegetative cover poor and no snails.

Sta. 93, dry slope southeast of Franklin, about half way to the base of the mountain, due north of the type locality of *Oreohelix haydeni corrugata* H. & D. *Succinea oregonensis* Lea was very abundant among the quartzite and red sandstone boulders thickly strewn over the surface of the gentle slope, sheltered by very scant vegetation growing close to the rocks. Tracks of horses and cattle made when the ground is soft after rains hold a little water for a short time after storms, thus insuring periods of activity sufficient to sustain a very prosperous colony of these snails. They were clinging to the rocks and to the soil beneath by means of a glutinous substance which caused the snails to stick to our fingers and tweezers in removing them from the rocks. Dry, membranous "scars" adhering to the rocks showed former places of attachment during periods of inactivity, reminding one of *Sonorella* scars. We obtained over a thousand specimens alive in a very short time on the Idaho side of the boundary, then found dead shells all along the way across the line into Utah, to the edge of the mouth of High Creek Canyon; but not realizing at the time that we were crossing the line, we did not look for live examples.

Sta. 94, small reservoir in shallow ravine north of Sta. 93. *Physa ampullacea* Gld., scarce.

Sta. 95, north side of High Creek Canyon, southeast of Sta. 93, just within the mouth of the canyon and continuing some distance up the canyon on the same side. *Oreohelix strigosa fragilis* (Hemph.) in quartzite and red sandstone slides.

Sta. 96, similar slides a mile or so up the canyon on the south side, the same subspecies, scarce. Further up the canyon the walls are of limestone, but strange to say our brief search there did not yield snails. Hemphill states that the type locality of *fragilis* is "near Franklin, Idaho, among Red Sandstone." The topography suggests this canyon as a very likely one for him to have visited, the other likely one being two or three miles to the north, a little north of east from Franklin and hence in Idaho. Our stations for this subspecies, 39 (1915), 95 and 96 (1916), are all in Utah. If Hemphill's type locality is any of these three, then the only Idaho station known for *fragilis* is Franklin Butte, west of the town, our Sta. 38, 1915.

SMITHFIELD, UTAH.

Sta. 101, limestone butte about two miles northeast of Smithfield. *Oreohelix peripherica* (Ancey), almost devoid of color bands—the *binneyi* form. A few live snails were found by persistent search, but dead, bleached shells were very abundant on the slopes to the top of the butte, thence to the north slope of the entrance to the canyon to the southeast. The butte has been considerably denuded by overgrazing, and erosion has washed the soil and dead leaves from beneath the shrubs and *Balsamorrhiza* that formerly afforded shelter for the snails. Bleached shells almost whitened the ground down the slopes from clumps of bushes where now there is no snail cover at all. It is difficult to see how the shrubbery can long continue to exist. As this butte is only six miles south of the *Oreohelix haydeni corrugata* butte, and the two buttes are of the same character, we expected to find that subspecies here, but failed to do so. Three buttes of similar character, placed at intervals of about six miles and almost in line, our stations 38, 40 and 101, yielded respectively *O. s. fragilis*, *O. h. corrugata* and *O. peripherica*.

We worked up the large canyon southeast of Sta. 101 for several miles, and were surprised to find no snails in it.

THE LOGAN, UTAH, DISTRICT.

This region is covered by the Logan Quadrangle topographic sheet of the United States Geological Survey, issued since our visit.

Sta. 86, north fork of Logan Canyon, about sixteen miles from Logan and three miles above "the forks." *Oreohelix strigosa depressa* (Ckll.) abundant under mountain maples at the edges of limestone slides, where the blanket of leaves was thick, but a few large rocks and roots provided clinging places for the snails. We also obtained the following species:

Thysanophora ingersolli (Bland).
Pupilla blandi (Morse) ? one broken shell.
Vitrina alaskana Dall.
Euconulus fulvus alaskensis Pils.
Zonitoides arborea (Say).
Pyramidula cronkhitei anthonyi Pils.
Succinea avara Say.

Thysanophora ingersolli was described by Bland[9] in 1875, under the name *Helix ingersollii*, from specimens obtained in Colorado. Ingersoll[10] republished the description in 1876, under the name

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[9] *Ann. N. Y. Lyc. Nat. Hist.*, XI, p. 151, 1875.

[10] 8th Ann. Rept. (Hayden's) U. S. Geol. and Geog. Surv. Terr., for 1874, pp. 397–398, 1876.

Microphysa ingersolli, with three outline figures which do not adequately represent the material he collected or any specimens we have seen from Colorado or elsewhere, and the lateral view is misleading. Binney,[11] in 1878, 1885, 1886 and 1890, again published misleading figures, perhaps based upon the original figures. These all represent a shell with apex so depressed that it does not show at all above the last whorl in lateral view. In 1887 Ancey,[12] relying upon the supposed accuracy of those misleading figures, as he plainly indicates, and finding that his specimens of *Thysanophora* collected by Hemphill in Logan Canyon, Utah, exhibited a spire elevated clearly above the last whorl, described it under the name *Microphysa ingersolli convexior*. Meanwhile Binney, in his second supplement, in presenting what he said was a better figure of *ingersolli*, recorded under that name material collected by Hemphill (doubtless part of the same lot of material from which Ancey's types came) at Logan Canyon and Mt. Nebo, Utah, and also Weston, Oregon. We have examined *Thysanophoras* from two stations in Logan Canyon, a number of other localities in Utah and Idaho and many localities in Colorado, some of them near the type locality of *ingersolli*, and can see no difference, none of them being accurately represented by the figures of *ingersolli*. Specimens from Logan Canyon were sent to Pilsbry, who compared them with Ingersoll's specimens of *ingersolli*. He agrees with us that the names are exact synonyms, *ingersolli*, of course, having priority. In 1890 Professor T. D. A. Cockerell was permitted to examine and copy portions of Ancey's manuscript notes, including notes on his *M. i. convexior*, with pen and ink figures. We have examined his copies of Ancey's figures, and the one labelled *ingersolli* represents Binney's misleading figure of the species, while the one labelled *convexior* is an excellent illustration of the shell found in Montana, Idaho, Utah, Colorado, New Mexico and doubtless Wyoming, and which must take the name *ingersolli*. It is interesting to note that though Binney recorded *ingersolli* from Weston, Oregon, collected by Hemphill, Pilsbry[13] recorded and figured specimens from the same place under the name *convexior*, because they had the spire considerably higher than material from Colorado and elsewhere. This confirms our conclusion that Binney was really dealing with a form having a slightly raised spire, while figuring one with the spire depressed out of sight in lateral view. If further material shows the Oregon form to be worthy a name, it should be given a new one and not called *convexior*.

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[11] Binney, Terr. Moll. U. S., vol. V, p. 173; 2d Suppl., p. 35, Pl. III, fig. 5; 3d Suppl., p. 215; Man. Amer. Land Shells, p. 170.

[12] *The Conchologist's Exchange*, vol. II, p. 64, 1887.

[13] PROC. ACAD. NAT. SCI. PHILA., LXII, 117, 1910.

Sta. 87, just within mouth of Logan Canyon, on south side. *Oreohelix strigosa depressa* (Ckll.) very abundant, rather small, nearly white, with two conspicuous, usually broad, dark brown bands, which almost invariably extend to the aperture. These are the most conspicuously banded snails we found during the two seasons' work, except *O. peripherica* form *albofasciata*. They were found scattered for a mile up the canyon, and were quite abundant in a small rock slide covered by *Clematis*. This station also yielded the following:

Vitrina alaskana Dall.
Pyramidula cronkhitei anthonyi Pils.
Thysanophora ingersolli (Bland).
Euconulus fulvus alaskensis Pils.

A spring choked with water-cress yielded *Paludestrina longinqua* (Gld.). Sterki[14] doubtfully recorded *Vallonia gracilicosta* Reinh. from Logan Canyon.

Sta. 88, about a mile up, on the south side of next large canyon, about two miles to the north from Logan Canyon. *Oreohelix strigosa depressa* (Ckll.), a few alive under mountain maples in the edges of rock slides, dead shells common.

Sta. 89, between 87 and 88, along the west slope of the mountain. *Oreohelix haydeni hybrida* (Hemph.), dead shells scattered, but especially common where limestone ledges are exposed at the mouths of small ravines. About a dozen live snails were found under sagebrush in rock slides, but none under *Balsamorrhiza*, which is usually excellent cover for *Oreohelix* where it droops over rocks. Here the plant was found in loose soil, not about the rocks. The evidence is abundant that the vegetative cover has here been greatly reduced by overgrazing, followed, as usual in such cases, by active erosion. The colony is likely near extinction. A few dead shells of *Vitrina alaskana* Dall were found.

Sta. 90, several steep, short ravines on the west slope of the mountains south of Logan Canyon and south of our Sta. 42, 1915. *Oreohelix haydeni hybrida* (Hemph.) found sparingly in all of these ravines. This form seems to be here confined to such situations and is not found in the larger canyons, which are the best places for *depressa* and *cooperi*.

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[14] Proc. Acad. Nat. Sci. Phila., 1893, p. 270; Man. Conch., 2d Ser., vol. VIII, p. 256.

Sta. 42, where in 1915 we collected *O. h. hybrida*, yielded in 1916 a single example of *Thysanophora ingersolli* (Bland), one *Euconulus fulvus alaskensis* Pils., and three *Vitrina alaskana* Dall.

Sta. 91, Providence Canyon, southeast of Providence and about four miles from Logan. *Oreohelix strigosa depressa* (Ckll.) and *O. cooperi* (W. G. B.), both rather small, dead shells plentiful, a few live examples found under mountain maples and various shrubs in rock slides.

Sta. 92, a small stream choked with water-cress, a mile south of Logan, yielded *Succinea rusticana* Gld., *Lymnæa proxima* Lea and *Physa ampullacea* Gld.

Baker, in his Lymnæidæ of North America, records *L. proxima* Lea and *L. stagnalis wasatchensis* Hemph. from "near Logan."

Clarkston, Utah.

Sta. 57, Newton town reservoir, about half way between Trenton and Clarkston:

Musculium sp.
Musculium rykholti Normand.
Succinea avara Say.
Lymnæa proxima Lea.
Planorbis trivolvis hornii Tryon.
Planorbis exacuous Say.
Planorbis parvus Say.
Physa ampullacea Gould.

Planorbis trivolvis hornii (so identified by Pilsbry) here varies from 19 mm. to 24 mm. in diameter. Our former record of *P. trivolvis* from Cache Junction should be referred to this form. Ingersoll[15] recorded *hornii* from Utah.

Sta. 58, mountainside due west of the southern portion of Clarkston, half a mile south of Sta. 3, 1915. *Oreohelix rugosa* (Hemph.) abundant and very robust, under *Balsamorrhiza sagittata* and small bushes, around limestone ledges. In places the ground is almost white with bleached shells, and we obtained a thousand live ones in a short time. In our former report we suggested (p. 334) the possibility that *O. hendersoni dakani* Hend. might be a synonym of *rugosa*, a suspicion then shared by Pilsbry.[16] We have since visited the type locality of *dakani* at Newcastle, Colorado, and obtained a large quantity of live specimens. Dr. Pilsbry has examined the anatomy of both forms, and reports that they are distinct, the anatomy of *dakani* proving its relationship to *hendersoni*, as was originally assumed from shell characters alone, while the anatomy of *rugosa* connects it with the *cooperi* group.

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[15] 8th Ann. Rept. (Hayden's), U. S. Geol and Geog. Surv. Terr., for 1874, p. 404.

[16] Proc. Acad. Nat. Sci. Phila., LXVIII, 353, 1916.

While in this district we discovered that our *O. peripherica* stations 4 and 36, 1915, are on opposite sides of the same small mountain. We were misled before by the fact that Daniels had approached his Sta. 4 from one direction, while we had together at a later date approached Sta. 36 from another direction.

DEWEYVILLE, UTAH.

Deweyville Postoffice is in Box Elder County, Utah, fifteen miles north of Brigham. Some confusion is likely to arise from the fact that the railroads, both steam and electric, passing through the town, have abbreviated the name to Dewey, though some maps and gazetteers locate a Dewey post village in Grand County. Specimens of *Oreohelix* collected and labelled by Hemphill, in the collection of Mr. Daniels, bear the locality label, "Dewey, Box Elder Co., Utah," and are designated as *utahensis*. Specimens in the Hemphill collection in the cabinet of Mrs. Ida S. Oldroyd, and others placed by her in the University of Colorado Museum, were labelled by Hemphill: "Smooth variety of *binneyi*, passing into *albida*. Dewey, Utah. Large." Another lot, designated by him as "var. *albida*," is from "Collinston, Utah," which is about five miles north of Deweyville, and three lots labelled *albida* by him are from Logan, according to the labels. A careful examination of this material under a lens convinces us that it is identical with the smooth form of *O. h. hybrida* from Sta. 102, which grades so completely into typical *hybrida* that we cannot consider it entitled to a separate name, even as a "form."

Sta. 102, mouth of first gulch northeast of Deweyville. *Oreohelix haydeni hybrida* (Hemph.), periphery quite rounded and spiral sculpture obscure in most examples, common under wild cherry and mountain maple overhanging limestone slides composed chiefly of small fragments. *Vitrina alaskana* Dall common.

Sta. 103, next gulch south of Sta. 102, southeast of Deweyville. *Oreohelix haydeni hybrida* (Hemph.) under same conditions as at Sta. 102, specimens more or less angled, but not on the average so much so as at Sta. 104, sculpture more pronounced than at Sta. 102 and less so than at Sta. 104.

Sta. 104, gulch about two miles south of Sta. 103, east of Madsen. *Oreohelix haydeni hybrida* (Hemph.) common under same conditions as at Sta. 102, strongly angled to slightly keeled, spiral sculpture well developed as seen under a lens, but much less pronounced than in *gabbiana* from Oquirrh Mountains, though many specimens are more angular than typical *hybrida* from Logan.

The material of these three stations taken as a whole seems to be clearly *hybrida,* and the variation within such short distances is characteristic of the various subspecies of *haydeni* wherever we have found small colonies of them not far apart, as at Devil's Slide and Oquirrh Mountain, Utah, and at Glenwood Springs, Colorado.

OGDEN, UTAH.

Sta. 105, mouth of Ogden Canyon. *Oreohelix strigosa depressa* (Ckll.), dead shells about the granite and quartzite slides for a mile up the canyon on both sides. Live examples were found by a moment's search at several points, particularly abundant under a large mat of *Clematis* on one quartzite slide. Bleached shells also extend along the west slope of the mountains to a gulch about a mile to the north, as far as we went. Brush fires swept the mountains some years ago, so the vegetative cover is now very poor and erosion is rapidly stripping the steep slopes. Binney[17] recorded *Pupilla blandi* (Morse) from Ogden and *Vertigo corpulenta* (Morse) from Ogden Canyon. Probably the latter record should be referred to *V. modesta parietalis* (Ancey),[18] of which Ogden Canyon is the type locality. Binney's material recorded as *corpulenta* was collected by Hemphill, and the fact that other material described by Ancey at about this time was received by him from the same collector makes the supposition that his *parietalis* was obtained by Hemphill reasonable, and hence probably Binney's and Ancey's records are not only from the same canyon, but from the same lot of material.

Sta. 106, a small, sluggish stream on south side of valley, about a mile below the mouth of Ogden Canyon:

Fluminicola fusca (Hald.).
Physa crandalli Baker ?
Lymnæa traskii Tryon.

Oreohelix peripherica wasatchensis (Hemph.).

Sta. 108, base of river terrace, south and southeast of Sta. 106, alluvium, enclosing fragments of limestone. Dead shells abundant, about 25 live examples found in a scrub oak and mountain-maple thicket. At this station the shells vary greatly in form, many being not distinctly carinated and much flatter and smoother than typical *wasatchensis,* thus forming an intergrading series between typical

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[17] 2d Suppl. to 5th vol. Terr. Moll., p. 40.

[18] *The Conchologists' Exchange,* vol. II, p. 80, 1887.

wasatchensis from the next station and *peripherica* from other localities. As we had expected, Pilsbry's report on the soft anatomy is that the genitalia of *wasatchensis* and *peripherica* agree. As usual, *Vitrina alaskana* Dall is common at this station.

Sta. 109. This station is east of, but continuous with, Sta. 108, the separation having been made only because of the greater variation at the lower end of the colony. Following up a draw toward the mountain, the smoother, depressed, non-angular form soon disappeared, but the typical, high-spired, strongly ribbed, carinated form was found plentifully under the leaves, often with very scant cover, a single small leaf being sometimes sufficient, though the weather was hot and dry. The colony continues up the mountain slope into a quartzite slide, where many of the large pieces of rock are well rounded. Some years ago brush fires burned the leaves to the bottom of the slides along this slope, so we were able to find no live snails above the brush in the ravine and along the side of the valley, which was not touched by fire. We had very carefully searched the region for several miles north and south and up the canyon for this species, but without success until we reached this place, which seemed to be the last chance. We are quite convinced that it is the exact type locality of the subspecies. It answers Hemphill's description, as no other place we found does, but he does not appear, from his notes, to have worked down into the gulch where the live snails are plentiful now. The topography and an old, abandoned road make it seem likely that he would have passed over this quartzite slide on his way to the mountain. In his description he says: "This pretty and interesting shell I found among quartzite boulders, in crevices sufficiently large to afford cool and moist retreats during the active summer season and safe places for hibernating during the cold months. This shell seems to be confined in its range to a very limited area, for I did not find a single specimen, either dead or alive, outside of a little plat containing an acre of ground." The last sentence quoted agrees with our experience, after collecting from 126 stations in Utah and southern Idaho. Hemphill's statement that almost the first shell he picked up at Ogden was *wasatchensis* indicates that he did not go first into the canyon, or he would have found there plenty of *depressa* and no *wasatchensis*.

PROMONTORY RANGE.

This range of mountains forms a narrow peninsula jutting into Great Salt Lake from the north. The southern portion formed an island perhaps twenty-five miles in length during the maximum expansion of ancient Lake Bonneville. Hague's[19] discussion is quoted at length by Butler and Heikes,[20] with additional information, in a recent bulletin. The isolation of the range and the presence of large bodies of limestone, brush and trees lead us to believe that systematic work there would produce interesting results, but our time was limited and the single day spent at the extreme southern end was disappointing. The only mollusks we saw were *Vallonia cyclophorella* Ancey and *Pupilla blandi* (Morse), under small bushes in rock slides at Sta. 107, an isolated limestone butte close to the railroad station of Saline. This butte was either covered by the waters of Lake Bonneville or formed only a tiny rocky island. The vegetative cover across the southern slope of the range is everywhere too scant for the larger snails.

MORGAN AND DEVIL'S SLIDE DISTRICT, UTAH.

Oreohelix haydeni (Gabb) was described from material said to have been obtained in "Webber" Canyon, Utah.[21] We have not been able to learn of any canyon bearing that name, and are assured by men long and well acquainted with Utah that the well-known Weber Canyon is the one intended. Unfortunately, that name has been sometimes used to designate the whole valley of the Weber River and its larger tributaries. It is quite desirable to find this species alive in the type locality or elsewhere, in order to ascertain the anatomy. In 1915 we searched for it in what is more properly called Weber Canyon, below Gateway, without success. In 1916 we made two trips to the upper canyon, above Morgan, without success so far as typical *haydeni* is concerned, but found other interesting forms. Between Morgan and Gateway, a broad valley, with canyons entering from both sides, and the whole canyon south of Echo[22] afford a large field as yet wholly untouched. Binney's[23] report of live *haydeni* received from Hemphill is incorrect, as Hemphill did not find true *haydeni*, though much of his material from the Oquirrh Mountains was sent out under that name.

Sta. 47, gulch on north side of valley, about half a mile north of Morgan depot. *Oreohelix peripherica* (Ancey), the *binneyi* (Hemph.) form, small, from 11 mm. to 16 mm. in diameter, mostly rather depressed, a very few showing one or two spiral color bands.

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[19] Hague, U. S. Geol. Explor. 40th Parallel, vol. 2, pp. 420–423.

[20] Butler and Heikes, U. S. Geol. Surv., Bull. No. 640-A, pp. 1-6.

[21] *Amer. Journ. Conch.*, V, p. 24, Pl. 8, fig. 1.

[22] See Coalville Quadrangle topographic sheet, U. S. Geol. Surv.

[23] Terr. Moll. U. S., V., p. 159; Man. Amer. Land Shells, p. 167.

Sta. 114, south side of canyon, about a mile southeast of Morgan depot, close to a big warm spring and picnic ground, where the broad valley narrows into the canyon, east side of a limestone ledge at the base of a red sandstone hill. *Oreohelix strigosa depressa* (Ckll.) abundant beneath *Balsamorrhiza sagittata,* sagebrush and other herbs and shrubs overhanging the rocks, but equally abundant deep in the red soil beneath such plants; an unusual habitat for this subspecies.

Sta. 115, west side of the same ledge, the same subspecies. Stations 114 and 115 constitute really a single colony, but we arbitrarily separated it and gave different numbers to our material, because many of the shells from one side of the ledge are more depressed than those from the other side, though the ledge is narrow and the colony actually extends across it.

Sta. 113, a short distance up the canyon from Sta. 114, on same side. *Oreohelix strigosa depressa* (Ckll.), dead shells very abundant on a limestone slope where the scrub oak and mountain maple thicket has recently been burned and all leaves and underbrush thus destroyed.

Sta. 112, big limestone slides not far above Sta. 113, on same side of canyon, concealed from the road by tall shrubbery. *Oreohelix strigosa depressa* (Ckll.), small (15 mm. to 18 mm. in diameter), white, strongly banded.

Sta. 111, next point of rocks, about 200 yards east of Sta. 112, at foot of canyon wall, beneath limestone ledge, perhaps two miles east of Morgan. *Oreohelix peripherica* (Ancey) common in leaves beneath scrub oaks and mountain maples, showing complete intergradation between Hemphill's *binneyi* and *albofasciata* forms, as at several stations in the Cache Junction district, discussed in our former report. This station is about 65 miles from Cache Junction in an air line. *O. peripherica* at all other stations where we have found it lacks the *albofasciata* form, so it is interesting to find the intergradation again at this most remote station for the species.

Sta. 110, some distance above Sta. 111, on same side of canyon, below the railroad tunnel, nearly opposite Sta. 53. *Oreohelix strigosa depressa* (Ckll.), dormant, deep in the rock slides and hard to find during the hot, dry season when we were there. Generally this subspecies has not been found by us very deep in the slides.

Sta. 48, both sides of and above the "slide," south side of canyon, Devil's Slide, Utah. *Oreohelix haydeni hybrida* (Hemph.) common beneath the heavy, drooping radical leaves of *Balsamorrhiza,* on steep limestone slopes, not in the rock slides. Dead shells plentiful. The vicinity is covered by a thick coat of lime dust from the cement plant. It is strange that any live examples were found under the circumstances.

Sta. 49, west slope of first gulch that enters the canyon from the north below the Devil's Slide depot. *Oreohelix haydeni* form *gabbiana* (Hemph.) under sagebrush, mountain maple, scrub oak, wild cherry and other shrubs at the edges of limestone slides, common alive, dead shells plentiful. The narrow-leafed cottonwood grove in the bottomland beneath the slides yielded:

Vitrina alaskana Dall.
Vallonia gracilicosta Reinh.
Pupilla blandi (Morse).
Pyramidula cronkhitei anthonyi Pils.
Zonitoides arborea (Say).

Sta. 50, pools beside the railroad track half a mile below Sta. 49.

Succinea rusticana Gld.
Lymnæa proxima Lea.
Physa crandalli Baker ?
Aplexa hypnorum (L.).
Paludestrina longinqua (Gld.).

Sta. 51, below Sta. 50, opposite (north of) the railroad tunnel, just east of a dry gulch that comes in from the north. *Oreohelix haydeni* form *gabbiana* (Hemph.) plentiful in edges of rock slides. The following were also found:

Vitrina alaskana Dall.
Euconulus fulvus alaskensis Pils.
Pyramidula cronkhitei anthonyi Pils.
Zonitoides arborea (Say).

Sta. 52, across the mouth of the gulch just mentioned, west of Sta. 51, thence along the base of the canyon wall for some distance around the curve. *Oreohelix haydeni* form *gabbiana* (Hemph.), less common than at Sta. 51.

Sta. 53, east-facing slope southwest of Sta. 52, west of the railroad tunnel, separated from Sta. 52 by a hundred yards or so of slope free from rock slides, where we found no snails. *Oreohelix haydeni* form *gabbiana* (Hemph.), a few found alive, dead shells plentiful.

Sta. 54, a mile down the canyon from Sta. 53, on an east-facing slope where the wagon road approaches the railroad. *Oreohelix haydeni hybrida* (Hemph.), plentiful under poison ivy in rock slides.

The *Oreohelices* from stations 48, 49, 51, 52, 53 and 54, all belong to the *haydeni* group. Hence the soft anatomy is the same and shell characters alone must be relied upon in their separation. Not a single example has as strong spiral sculpture as typical *haydeni* or *oquirrhensis,* though a few approach it. *O. h. hybrida,* from its type locality at Logan, is readily distinguished from *O. h.* form *gabbiana* from its type locality in the Oquirrh Mountains, but at these stations we have a puzzling mixture and variation of characters, so that the determinations are made with some hesitation. The stations are not far apart and in the same canyon, so they may almost be considered one large colony. The form at the extremes of the colony so considered, stations 48 and 54, seems referable to *hybrida,* a considerable proportion of those from Sta. 48 being typical, others varying more or less in peripheral angulation and the altitude of the spire, but the spiral sculpture in those from Sta. 54 is obscure, much weaker than in the typical form. Both lots have the whorls well rounded from above and below to the more or less angled, but not keeled, periphery. The form at Sta. 49 (next to 48) and Sta. 53 (next to 54), we refer to *gabbiana,* not typical. It is really transitional from the *hybrida* of 48 and 54 to the *gabbiana* of 51 and 52. On the average the whorls are not so well rounded, the spire flatter and the angulation more pronounced, though they are somewhat variable in all these characters. On the whole, they seem more nearly related to the form at the nearest stations, 51 and 52, than to the form at the more remote stations, 48 and 54. Some examples are entirely indistinguishable from material labelled *utahensis* from Hemphill's collection. The form at stations 51 and 52, which we refer to *gabbiana,* has a depressed spire and the whorls slope rather flatly from above and below to a keeled periphery. The spiral sculpture is variable, the primary spirals in some examples being nearly as strong as those in typical *oquirrhensis,* though only indistinctly seen in others. These forms are further discussed in the sections on Deweyville and Oquirrh Mountains.

Sta. 55, a small stream by the roadside, perhaps a mile and a half above Morgan, below Sta. 54.

Lymnœa proxima Lea.
Physa ampullacea Gld.
Aplexa hypnorum (L.).

Sta. 56, pool by the roadside, about a mile above Morgan, just above where the wagon road crosses the railroad.

Pisidium near *huachucanum* Pils.
Paludestrina longinqua (Gld.).
Lymnœa proxima Lea.
Lymnœa humilis modicella Say.
Planorbis parvus Say.
Physa ampullacea Gld. ?

Sterki says of the *Pisidium:* "*P. huachucanum* Pils., or near. Somewhat different from the originals; somewhat smaller (all specimens may not be full-grown); superior margin not so straight; beaks somewhat narrower."

Stations 47 and 49 to 56 are all on the north side of the canyon, while stations 48 and 110 to 115 are on the south side.

Salt Lake City, Utah.

We did not stop at Salt Lake City to do any collecting in 1916, but have recently received from Mr. L. A. Giddings, of that city, two small lots of *Oreohelix strigosa depressa* form *carnea* (Hemph.), one from his Sta. 1, upper slopes of Red Butte Canyon, the other from his Sta. 2, close to the creek in City Creek Canyon. In both lots the spires are much more elevated than usual, but otherwise they correspond with Hemphill's specimens of *carnea*, of which the type locality is "near Salt Lake, Utah," and which we found in Dry Canyon in 1915. Pilsbry writes that the anatomy is that of *depressa*. It may be well to say that this form, sent out by Hemphill, is to be found in many cabinets bearing a printed label on which, by a typographical error, an *o* has taken the place of an *a*, making the name *corneus*, which should be corrected. We also note another typographical error in Hemphill's printed labels, the *i* having been omitted from *gabbiana*.

Call[24] reported the following species from this locality:

Pisidium abditum Hald. (= *Pisidium* ?).
Margaritana margaritifera (Linn.).
Anodonta nuttalliana Lea.
Valvata sincera (Say).
Valvata utahensis (Call).
Lymnæa stagnalis Linn.
Planorbis opercularis Gld.
Planorbis parvus Say.
Planorbis trivolvis Say.
Physa gyrina elliptica Lea.

As he placed *A. wahlametensis* Lea and *A. californiensis* Lea in the synonymy of *A. nuttalliana* Lea, which of these forms he found "somewhat common in the fresh-water streams near Salt Lake City" is an open question. His *L. stagnalis* is either *appressa* or *wasatchensis*. Baker[25] reports *L. s. wasatchensis* and *L. proxima* Lea from near Salt Lake City. Yarrow[26] reports *L. stagnalis* and *Valvata sincera* from "near Salt Lake City." Ingersoll[27] also records *V. sincera* from here. Probably all these records of *V. sincera* should be referred to *V. humeralis californica* Pils. Ingersoll also (on the same page of his report) records *Fluminicola seminalis* Hinds and *F. hindsi* Stm. from "Salt Lake, Utah," and *F. nuttalliana* Stm. from "Warm Springs, near Salt Lake, Utah." The two last mentioned may well be doubted. He also, on p. 399, records *Succinea nuttalliana* Lea from the Warm Springs locality—a doubtful record. Binney[28] records *Succinea haydeni* W. G. B. from Salt Lake City.

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[24] U. S. Geol. Surv., Bull. 11, 1884.

[25] Lymnæidæ of North America, pp. 152, 359.

[26] (Wheeler's) U. S. Geog. Surv. W. of 100th Meridian, V, pp. 941, 948.

[27] 8th Ann. Rept. (Hayden's) U. S. Geol. and Geog. Surv. Terr., for 1874, p. 390.

UTAH LAKE, UTAH.

This district is covered by the Salt Lake topographic sheet of the United States Geological Survey. Utah Lake was included in Lake Bonneville during the "Lake Period." It now remains fresh because it has an outlet, the Jordan River, through which it drains into Great Salt Lake. However, the water is said to be not so free from salts as formerly, owing to the extensive use of water for irrigation. Cameron[29] reports that the mineral content, chiefly sodium chloride, of the lake water increased from 300 parts of total solids per million parts of solution in 1883, to 1,400 parts per million in 1903—a period of twenty years. It is not likely that the salinity will increase so much as to be fatal to fresh-water mollusks or even to seriously modify them. Call[30] and Stearns have discussed the influence of temperature and salinity in modifying the shells of this region, and the arid region farther west. In his bulletin Call records the following species from Utah Lake:

Pisidium compressum Prime.
Sphærium dentatum (Hald.).
Ancylus sp.
Carinifex newberryi (Lea), living.
Fluminicola fusca (Hald.).
Lymnæa stagnalis Linn.
Lymnæa utahensis Call.
Physa ampullacea Gld.
Physa gyrina elliptica Lea.

His assertion that *S. dentatum* here attains great size strongly suggests that he really found *P. pilsbryanum* Sterki, which was not then described, but has since been described from Bear Lake (fossil) and reported from Utah Lake (recent) by Sterki.[31] Yarrow[32] reports finding *Lymnæa stagnalis* [= *appressa*] and *Planorbis trivolvis* Say at Utah Lake, but says he found the latter alive at only one locality in Utah, namely, near Salt Lake City. Ingersoll[33] reports *Fluminicola fusca* (Hald.) from Utah Lake, placing it in the family Amnicolidæ and on the same page repeated the same record under the name *Leptoxis fusca* in the family Melaniidæ. His Utah Lake record of *Lymnæa catascopium* Say cannot be accepted. Pilsbry[34] records *Paludestrina longinqua* (Gld.) from Utah Lake; *Fluminicola fusca* (Hald.) from Utah Lake, Bear Lake and Malad River, and *Amnicola limosa* (Say) from Utah Lake and Spring Lake.

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[28] 2d Suppl. to 5th vol. Terr. Moll., p. 40.

[29] Cameron, "The Water of Utah Lake," *Science*, n. s., vol. XXI, p. 257, 1905.

[30] Call, U. S. Geol. Surv., Bull. No. 11, 1884. Stearns, *Proc. U. S. Nat. Mus.*, XXIV, 1901, 271–299; N. Amer. Fauna, No. 7, pp. 269–283.

[31] Sterki, "Sphærium pilsbryanum n. sp.," *The Nautilus*, XXII, pp. 141–142, 1909; "A preliminary catalog of the North American Sphæriidæ," Annals of Carnegie Museum, X, p. 437, 1916.

[32] Yarrow, (Wheeler's) U. S. Geog. Surv. W. of 100th Meridian, V, pp. 941, 946–947, 1875.

Sta. 127, shore of Utah Lake and adjacent slough, two miles south of Lehi, Utah. Very few live mollusks were found except *Succinea*, but dead shells were abundant, as follows:

Sphærium pilsbryanum Sterki.
Pisidium near *variabile* Prime.
Pisidium sp.
Anodonta wahlamatensis Lea.
Succinea haydeni W. G. B., living.
Vitrea hammonis Ström.
Euconulus fulvus alaskensis Pils.
Zonitoides arborea (Say).
Carinifex newberryi (Lea).
Fluminicola seminalis (Hinds).
Fluminicola fusca (Hald.).
Amnicola limosa (Say).
Paludestrina longinqua (Gld.).
Valvata humeralis californica Pils.
Valvata utahensis (Call), type locality.
Ancylus sp.
Lymnæa proxima Lea.
Lymnæa stagnalis appressa Say.
Lymnæa utahensis Call, type locality.
Lymnæa humilis modicella Say.
Lymnæa obrussa Say.
Planorbis trivolvis binneyi Tryon.
Planorbis parvus Say.
Physa lordi Baird.

P. t. binneyi here attains large size, the largest one measured having a diameter of 36 mm., and all specimens collected have the characteristic strap-like whorls and strong sculpture of this form, but the aperture is considerably expanded and not quite typical. Judged by Baird's description and Binney's figures, the *Physa* from this station appears to be true *P. lordi*. Material from the Douglas Lake district, Michigan, referred by some conchologists to *lordi*, by others to *P. ancillaria parkeri*, differs markedly from the Utah Lake form and Binney's figures in its tabulate form, which is due to the decidedly flat upper surface of the last whorl and the much more acute angulation of the shoulder. The same is true of material from Chelsea, Quebec, though the difference in that case is not so marked or uniform. *Valvata h. californica* here is less highly polished and more loosely coiled than at Sta. 78, Bear Lake.

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[33] 8th Ann. Rept. (Hayden's) U. S. Geol. and Geog. Surv. Terr., for 1874, pp. 391, 406.

[34] Pilsbry, "Catalogue of Amnicolidæ of the Western United States," *The Nautilus*, XII, pp. 122–123, 1899.

Sta. 125, creek and sloughs south of Provo, from one to two miles north of Springville.

Succinea haydeni W. G. B.
Paludestrina longinqua (Gld.).
Fluminicola fusca (Hald.).
Valvata humeralis californica Pils.
Lymnæa proxima Lea.
Lymnæa stagnalis appressa Say.
Lymnæa humilis modicella Say.
Planorbis trivolvis near *binneyi* Tryon.
Planorbis parvus Say.
Physa crandalli Baker ?

The *Planorbis* cf. *binneyi* here is much smaller than at Sta. 127, the largest measuring only 20.5 mm. in diameter; some as strongly sculptured, but the whorls not so strap-like; some with the nearly circular aperture of *hornii* Tryon. Yarrow[35] records *Physa elliptica* Lea from Provo, Rush Lake and Virgin River, Utah. To what species his records should be referred we do not know. Crandall[36] confines *P. elliptica* to the region east of the Mississippi.

Sta. 126, gulch a mile and a half northeast of Springville. *Oreohelix strigosa depressa* (Ckll.), a few dead shells found, no live examples obtained.

Oquirrh Mountains, Utah.

We spent one rainy day at Bingham. Such investigation as we were able to make in the rain led to the conclusion that it is not good snail territory, though doubtless more extensive and persistent search would result in some finds.

Sta. 116, rock slides and ledges, chiefly limestone, south and southeast of Garfield, on the ancient lake terraces at the northern end of the range. *Oreohelix cooperi* (W. G. B.) (?), plentiful in rock slides, but several hours of digging deep into the slides and under the new growth of shrubs failed to produce a single live snail. The dead shells were weathered and scorched, the periostracum and embryonic sculpture destroyed, so we do not feel confident of their identity.

Sta. 117, gravel pit on one of the lake terraces north of the west edge of Garfield. This pit yielded fossil fresh-water shells of species living now in the region, and added nothing to the fossils recorded from the region by Call.

Sta. 118, sloughs between the west end of Garfield and the main line of the railroad.

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[35] (Wheeler's) U. S. Geog. Surv. W. of 100th Meridian, V, p. 937.
[36] *The Nautilus*, XV, pp. 54–55, 1901.

Lymnœa traskii Tryon. *Physa* sp.
Planorbis parvus Say.

Call[37] records *Paludestrina longinqua* (Gld.) from Lake Point, a short distance west of Garfield, and Pilsbry[38] records *Amnicola* (*Cincinnatia*) *cincinnatiensis* (Anth.) from the same place, as well as from Salt Lake and the Sevier Lake Valley.

Sta. 14, southeast of Black Rock, in a small ravine, above the lowest prominent limestone ledge and below the second one.

Sta. 119, down the slope from Sta. 14, below the lower ledge.

Sta. 15, gulch southeast of the railroad flag station of Morris, perhaps four or five miles south of Sta. 14.

Sta. 123, south side of a ravine about half a mile north of Sta. 15.

Sta. 122, next gulch north of Sta. 123.

Sta. 121, west slope of mountain and next gulch north of Sta. 122, almost connecting with Sta. 120.

Sta. 120, gulch and divide north of Sta. 121.

Oreohelix haydeni oquirrhensis (Hemph.).

Patula strigosa var. *oquirrhensis*, Hemphill, Binney's 2d Suppl. to 5th vol. of Terr. Moll. U. S., pp. 30, 34, Pl. II, fig. 12.

Patula strigosa var. *gabbiana* Hemphill, Binney's 2d Suppl. to 5th vol. Terr. Moll., pp. 30, 34, Pl. II, fig. 9.

Patula strigosa var. *utahensis* Hemphill, Binney's 2d Suppl. to 5th vol. of Terr. Moll.

Further collections in the Oquirrh Mountains and a careful study of the material obtained by us, as well as a study of Hemphill's material, convinces us that the forms above mentioned cannot be considered distinct subspecies, though the names may be useful as descriptive terms by which to designate the different phases. Typical *oquirrhensis* is a robust shell, with strong revolving ribs. The form *gabbiana* is less robust, with less pronounced and sometimes almost obsolete ribs. The form *utahensis*, as distributed by Hemphill, is smoother than *gabbiana*, with a less pronounced keel. Though the extremes are so very different, complete intergradation is found within a short distance, and in each gulch there is a considerable difference in shape, size and sculpture. In our former report we referred a few shells obtained at Sta. 14 to *gabbiana*. We revisited this station and Sta. 119, a few rods below 14, and found dead shells rather common in small rock slides, but a thorough search of the slides and the scant shrubbery brought to light no live examples. This material seems referable to the form *utahensis*, of which these stations are possibly the type locality, described as a "detached pile of rocks," "at the foot of the mountain." It has seemed almost hopeless to recognize *utahensis*. Pilsbry[39] has discussed the confusion in which he found the descriptions and figures of this form. Hemphill's description (in a letter to Binney) was quite inadequate, as follows:

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[37] U. S. Geol. Surv., Bull. 11, p. 20.

[38] *The Nautilus*, XII, p. 122, 1889.

"This has the form of *hemphilli*, but is destitute of the revolving ridges of *haydeni*. The specimens were all constant in sculpturing, but varied very much in size and somewhat in form."

Binney published the letter, and on a subsequent page of the same publication says of *utahensis*:

"This is a rough, coarse, carinated *strigosa*, figured in *Terr. Moll.*, V, p. 158, fig. 66. The peristome is sometimes continuous by a heavy raised callus, connecting its terminations. It is sometimes smaller and more elevated."

As Pilsbry has pointed out, the figure referred to was based upon material from Big Horn Basin, Wyoming, and Binney added characters belonging to the Wyoming form, now known as *O. strigosa magnicornu* Pils. The connected terminations of the peristome is a common feature in a number of species of *Oreohelix*, including Hemphill's forms *oquirrhensis* and *gabbiana*, and hence is not of diagnostic significance. Material we have seen from the Hemphill collection, bearing the name *utahensis*, is mostly labelled "near Salt Lake," but one small lot is labelled "near Logan." We cannot know whether any of it came from Oquirrh Mountains, but it all agrees quite well with our stations 14 and 119 material. The exact type locality of *utahensis* is not known, except that it is on the west side of this range, and there is no more probable place than these two stations, which really form but one small colony, being each of small extent and but a few rods apart. We cannot ascertain from the descriptions and figures alone, with certainty, just what *utahensis* is. Material from Hemphill's collection does not settle it, because of the absence of designated types and cotypes, the uncertainty as to whether any we have seen are even topotypes, and the fact that he apparently used that name for more than one form. His *hemphilli*, with which he compared *utahensis*, is not true *hemphilli*, but is the material he collected in the Oquirrh Mountains and distributed under that name, which cannot be separated from his *oquirrhensis* from the same locality. By referring to the descriptions and figures,[40] we find that *oquirrhensis* has very strong ribs and is keeled, agreeing with specimens he distributed under that name and with our material from Sta. 120; while in his *gabbiana* the spirals are quite weak or nearly obsolete, with the periphery compressed into a distinct keel, the primary spirals being usually visible to the unaided eye, the secondaries visible under a lens, thus agreeing in all respects with the material from our Sta. 15. It has distinctly the two series of spirals characteristic of the *haydeni* group—a few ribs, with intercalated riblets. Our stations 14 and 119 specimens, which we consider of the *utahensis* form, are well angled, but the periphery is not pinched into a keel. There is perhaps a little greater variation in the altitude of the spire. The spiral sculpture is weaker, and in most examples the microscopic riblets are crowded and subequal, instead of a few stronger ribs with intercalated riblets. However, in a few examples the compound spiral sculpture is distinctly present, thus forming a series grading into the form *gabbiana*. Viewed in mass, material from stations 14 and 119 can be distinguished at once from that found at Sta. 15, and Sta. 15 material can be distinguished from that found at Sta. 120, but plenty of individuals are found to connect them all. If anyone insists upon considering these forms sufficiently distinct, in spite of complete intergradation, to merit separate names, then *utahensis* should be applied to the Sta. 14 form, as it is usually "destitute of the revolving ribs [not of the riblets] of *haydeni*," a description not at all fitting other forms from this region. In selecting a name, it would seem most natural to select the one occurring first in the original publication, though all occur on the same page in Hemphill's letter to Binney. That would be *utahensis*. The same thing would result if we select the first one in Binney's notes, as *utahensis* precedes *oquirrhensis* and *gabbiana* by one page. We have seen the difficulty of recognizing *utahensis*, while *oquirrhensis* is well figured and sufficiently described. The confused description and figure do not satisfy the priority rule requiring a name to be accompanied by a description, in order to be accepted. Part of the description flatly contradicts the Hemphill specimens, which would otherwise perhaps enable us to definitely decide what the name applied to. The rules of nomenclature justify the selection of the name *oquirrhensis*, instead of *utahensis*, under the circumstances. Especially is this course justified by Art. 28 of the International Code of Zoological Nomenclature, which provides that "if the names are of the same date, that selected by the first reviser shall stand," and recommendation *b*, that a specific name accompanied by both description and figure stands in preference to one accompanied only by a diagnosis or only by a figure, the figure of *utahensis* in the present case being either spurious or doubtful. The page precedence recommendation (*c*) only applies when "other things are equal." The name *utahensis* should be dropped and *gabbiana* used (if at all) only as a "form" name, not in a subspecific sense.

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[39] *Nautilus*, XXIX, pp. 139–141, 1916.

[40] Binney's 2d Suppl. to 5th vol. Terr. Moll., pp. 30, 34, Pl. II, figs. 9, 12.

We revisited Sta. 15 and found one live example of the *gabbiana* form, so it is possible that the colony may survive the destructive fire of 1915, as a new growth of scrub oak is starting and will soon furnish fair cover.

Starting at Sta. 120, we found old, bleached shells of *Oreohelix haydeni oquirrhensis* (Hemph.), robust and strongly ribbed spirally, though the ribbing is somewhat variable. The ribs below the sharply keeled periphery vary from four to seven and are usually somewhat unequal in prominence or spacing or both. Above the keel there are usually four ribs, sometimes only three. These shells are very abundant among the charred stumps of scrub-oak thickets, which had been recently burned, but were not found in the rock slides. Persistent search up the gulch and across the low divide to the south, failed to reveal a single live snail, though everywhere "bones" were plentiful to the top of the divide. They are all much weathered. Our impression is that the colony may have been destroyed long ago, as this portion of the range has apparently been swept by fires before, and is now barren for many miles. Hemphill found this form abundant alive somewhere near here over thirty years ago. We found a number of bleached shells which we doubtfully assign to *Succinea oregonensis* Lea. They vary from grosvenori-like to avara-like shells. The absence of color enhances the difficulty of specific determination.

Probably the colony of Sta. 120 crosses the divide well up the mountain, and thus connects with Sta. 121, in the next ravine, where the same subspecies of *Oreohelix* was found, all dead shells, some nearly as coarsely ribbed as at Sta. 120, though the average examples have much less conspicuous ribs, usually seven or eight below, occasionally only four.

At Sta. 122, on the west slope of the mountain, not in the gulch, but only a short distance from 121, the few examples found, all dead shells, are smaller, slightly flatter and smoother than at Sta. 121, very near typical *O. h. gabbiana* (Hemph.), but exhibiting a tendency to grade into *oquirrhensis.*

This near-gabbiana form was found again at Sta. 123, but the shells here were somewhat larger.

Material reported from these mountains by Hemphill under the names *haydeni*, *hemphilli* and *oquirrhensis* is all *oquirrhensis*. Repeated careful examinations, by one of the present writers, of such material in several Hemphill collections, fail to discover any basis for or consistency in his separation of the material. Professor T. D. A. Cockerell and Dr. Paul Bartsch recently, at our request, compared examples of *oquirrhensis* from our Sta. 120 with three examples from the type lot of *haydeni*, from Weber Canyon, in the United States National Museum, and find them "quite distinct." Professor Cockerell writes: "The difference in the spiral keels is constant. In *haydeni* the whorls are rounded, the keels subequal, and the peripheral keel not distinct as in the Oquirrh Mountain specimens. *Haydeni* has a distinct channel below the suture, which is not present in the Oquirrh Mountain material."

EUREKA, UTAH.

Sta. 6, north side of Godiva Mountain, in the southeast edge of the town. In 1915, in collecting about 800 specimens of the small form of *Oreohelix cooperi* (W. G. B.) at this station, we obtained the type lot of *O. hemphilli eurekensis* H. and D., only seven specimens, all dead shells. In 1916 we revisited the station, but found no more of the *eurekensis* until we crossed a shallow ravine which marked the eastern boundary of our former work. There we found the small *cooperi* and *eurekensis* about equally plentiful, and obtained about 600 of the latter, mostly alive. The anatomy of *eurekensis*, according to Pilsbry, shows relationship to the southern *yavapai* group. The anatomy of *hemphilli* is as yet unknown, *eurekensis* being designated a subspecies of it on shell characters only. We also found at this station *Pupilla blandi* (Morse), common; *Succinea avara* Say (?), a few worn specimens; *Vallonia cyclophorella* Ancey, rare.

Sta. 124, west slope of Pinyon Mountain, three miles northeast of Eureka. *Oreohelix strigosa depressa* (Ckll.), a few small, dead shells beneath *Kunzia tridentata* near limestone ledges. We found none alive and no dead shells in the rock slides, though we made a long search for them. A box containing the same form is in Mrs. Oldroyd's Hemphill collection, bearing the following label: "Var. *albida*, *corneus*, etc., Eureka, Utah, 1912. Oiled." The shells are a little larger than those we found.